PROCEEDINGS

OF

THE ROYAL SOCIETY.

1833–1834. No. 16.

April 10, 1834.

JOHN WILLIAM LUBBOCK, Esq., M.A., V.P. and Treasurer, in the Chair.

The Right Hon. Edwin Viscount Adare; Charles Ansell, Esq.; Felix Booth, Esq.; Lieut. Alexander Burnes, E.I.C.; Francis Corbaux, Esq.; Sir William Browne Folkes, Bart., M.P.; James William Freshfield, Esq.; John Davies Gilbert, Esq., M.A.; Edward Griffith, Esq.; Edmund Halswell, Esq., M.A.; William Charles Henry, M.D.; Robert Hudson, Esq.; Rev. William Forster Lloyd, M.A.; John Phillips, Esq.; Captain Walter Nugent Smee, E.I.C.; William Spence, Esq.; Henry Sykes Thornton, Esq., M.A.; John Warburton, M.D.; and Horace Hayman Wilson, Esq., were elected Fellows of the Society.

A paper was read, entitled, "On a General Method in Dynamics, by which the Study of the Motions of all free Systems of attracting or repelling Points is reduced to the Search and Differenciation of one central Relation, or characteristic Function." By William Rowan Hamilton, Esq., Andrews Professor of Astronomy in the University of Dublin, and Royal Astronomer of Ireland. Communicated by Captain Beaufort, R.N., F.R.S.

After some introductory remarks illustrative of the scope and design of this paper, the object of which is sufficiently pointed out in its title, the author considers, 1st, the integration of the equations of motion of a system, the characteristic function of such motion, and the law of varying action; 2nd, the verification of the foregoing integrals; 3rd, the introduction of relative or polar co-ordinates, or other marks of position of a system; 4th, the separation of the relative motion of a system from the motion of its centre of gravity, the characteristic function for such relative motion, and the law of its variation; 5th, the systems of two points in general, and the characteristic function of the motion of any binary system; 6th, the undisturbed motion of a planet or comet about the sun, and the dependence of the characteristic function of elliptic or parabolic motion on the chord and the sum of the radii; 7th, the systems of three points in general, and their characteristic functions; 8th, a general method of improving an approximate expression for the characteristic function of motion of a system, in any dynamical problem; 9th, the application of the foregoing method to the case of a ternary or multiple system, with any

laws of attraction or repulsion, and with one predominant mass; 10th, the rigorous transition from the theory of binary to that of multiple systems, by means of the disturbing part of the whole characteristic function, and approximate expressions for the perturbations.

A paper was also read, entitled, "Observations on the Motions of Shingle Beaches." By Henry R. Palmer, Esq., F.R.S.

The author states that the object of his inquiries is limited to the collection of such facts as may assist in establishing practical rules for controlling the motions of the beach, with a view, on the one hand, to the preservation of clear channels where such are wanted, and on the other, to the obtaining accumulations of shingles in situations where they may be useful. He considers the actions of the sea on the loose pebbles as of three kinds; the first, which he terms the *accumulative action*, heaps up or accumulates the pebbles against the shore; the second, or the *destructive action*, disturbs and breaks down the accumulations previously made; and the third, or *progressive action*, carries the pebbles forwards in a horizontal direction. The causes of these actions are referable to two kinds of forces; the one being that of the current, or the motion of the general body of the water in the ebbing and flowing of the tides; and the other that of the waves, or that undulating motion given to the water by the action of the winds upon it.

He adduces many facts which show that it is not, as is generally believed, the currents which move the pebbles along the coast, the real agent being the force of the waves, the direction of which is determined principally by that of the prevailing winds, which, on the coasts of Kent and Sussex, where the author's observations were chiefly made, is from the westward. Every breaker drives before it the loose materials which it meets, throwing them up on the inclined plane on which they rest, and in a direction corresponding generally with that of the breaker. In all cases, the finer particles descend the whole distance with the returning breaker, unless accidentally deposited in some interstice; but the larger pebbles return only a part of the distance, this distance having an inverse ratio to its magnitude. This process constitutes the accumulative action. Under other circumstances, on the contrary, depending on the quickness of succession of the breakers, pebbles of every dimension return the whole distance along which they had been carried up, and are also accompanied in their recession by other pebbles, which had been previously deposited; and this constitutes the destructive action. This latter action is also promoted by a form of coast, such as that produced by rocks, tending to confine the returning waves in particular channels, whereby, being collected into streams instead of being broken and dispersed, they acquire, on the recoil, sufficient force to carry down the pubbles, and deposit them below the general surface. The author gives examples of these effects, from what he has observed in the neighbourhood of the harbours of Folkstone, Dover and Sandgate, and along the coast as far as the bay called Sandwich Flats; accompanied by illustrative drawings